



# X-ray/optical correlations in the black hole candidate system KV UMa (XTE J1118+48)

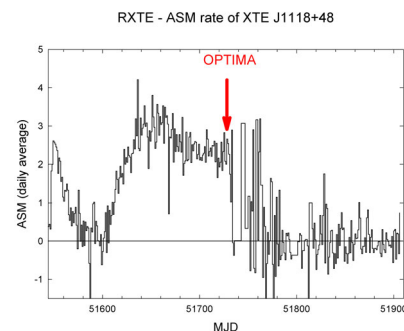


From January to August 2000 the bright X-ray transient XTE J1118+48 (=KV UMa) provided a unique opportunity for simultaneous X-ray and optical observations. KV UMa is a nearby binary system ( $\sim 2$  kpc) at high galactic latitude and contains a compact star with estimated mass of  $> 6 M_{\odot}$ . The MPE fast timing photometer OPTIMA (Straubmeier et al., 2001) was used on the 1.3m telescope at Skinakas observatory in conjunction with RXTE for a simultaneous exposure of 2.5 hours over the consecutive nights of July 4-7, 2000 (figure 1). The short time variable emission from the black hole candidate at X- and optical wavelengths was recorded with a timing accuracy of a few  $\sim \mu\text{s}$ . The X-ray to optical cross-correlation (figure 2), shows that the optical emission rises suddenly following an increase in X-ray output. A curious dimming of the optical light is also apparent 2-5 s before the X-rays. The positive optical response lags the X-rays by typically 500 ms, with a very fast onset of  $\sim 30$  ms (Kanbach et al., 2001). Although this delayed optical emission is suggestive of a reprocessing scenario (light echo), the autocorrelation of the X-ray and optical time series shows that the latter has intrinsically a much faster timing structure. This argues strongly against reprocessing. It is therefore proposed that the optical light is separately generated as cyclosynchrotron emission in a region about 20000 km from the black hole. The delay is then explained as a time of flight delay of disturbances in a relatively slow ( $\sim 0.1$  c) magnetically controlled outflow. More detailed analyses of the optical response components, especially the mysterious 'pre-cognition dip' are in preparation (Spruit and Kanbach, 2002)

*Figure 2: Sketch of an accreting black hole binary system. The black hole is surrounded by an accretion disk and emits a highly relativistic jet and the new hypothetical slow outflow. The optical response correlated to X-ray variations of XTE J118+48 shows time delayed emission and a preceding dip (,pre-cognition' dip).*

## References:

- Kanbach, G., et al., (2001), Nature, **414**, 180
- Spruit, H., and Kanbach G., (2002) submitted to A&A
- Straubmeier, C., et al., (2001) Exp. Astron., **11**, 157



*Figure 1: The X-ray transient XTE J1118+48 in outburst between January and August, 2000. The time of simultaneous optical observations on 4-7 July 2000 with OPTIMA is indicated.*

